

An Estimation of Hardware Approach, Fabrication and Detecting of Biquad Antenna About 3 GHz

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ABSTRACT

In the present paper an investigation has been carried out to develop hardware approach, fabrication and detecting of biquad antenna about 3 GHz. A Biquad antenna has been constructed and detected its frequency range. Since 1986, FCC rules have provided for unlicensed spread-spectrum operation in the 915 MHz (902–928 MHz), 2.4 GHz (2400–2483.5 MHz), and 5.7 GHz (5725–5850 MHz) bands. But a vast number of RF devices currently operate in the 2.4 GHz band (like microwave ovens, cordless telephones, medical devices etc.). Recently there has been proliferation of "Wi-Fi" hotspots and wireless computers permitting undeterred internet access by the public and RF identification (RFID) technology. A biquad antenna is a wide band antenna. These antennas are fairly directive, cheap and simple to make. A biquad is nothing but two single turn loop antennas forming an array where each one is a driven component. Further it has been found that the biquad antenna that it has been made a combination of two one wavelength square loop antennas. It has one quarter wavelength sides. For one wavelength perimeter it is reasonable to assume that current distribution is sinusoidal and continuous around the loop.

Keywords: Biquad antenna, loop antenna.

1.1 INTRODUCTION

A biquad antenna is a wide band antenna. These antennas are fairly directive, cheap and simple to make. A biquad is nothing but two single turn loop antennas forming an array where each one is a driven component. The array improves the directivity and bandwidth. The working of a biquad is the same as a folded dipole antenna. It generates the same radiation pattern as a dipole with more directivity and bandwidth. A biquad antenna can be considered as a modified form of a folded dipole antenna. More specifically its elements come under the category of small loop single turn antennas.

1.2 THEORITICAL CONSIDERATION

A small loop is the dual of an ideal dipole. Pattern and radiation resistance of a loop are insensitive to the loop shape and depend only on the loop area. Radiation from a small loop is highest in the plane of loop and zero along its axis. As the perimeter of a loop antenna becomes a sizeable fraction of a wavelength, the current amplitude and phase will vary over the wire extent. So, a loop antenna with a perimeter that is of the order of half-wavelength or larger will display performance variation with loop size and shape.

The biquad antenna that it has been made, is a combination of two one wavelength square loop antennas. It has one quarter wavelength sides. For one wavelength perimeter it is reasonable to assume that current distribution is sinusoidal and continuous around the loop.

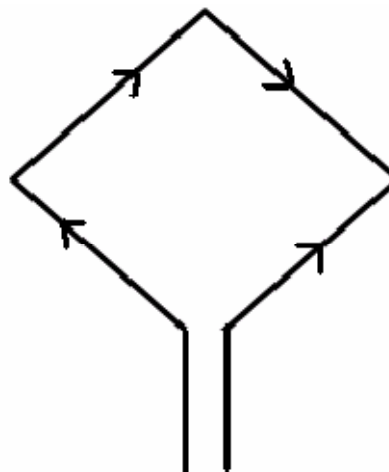


Fig. - 1.2.1 - Square loop

1.3 CONSTRUCTION

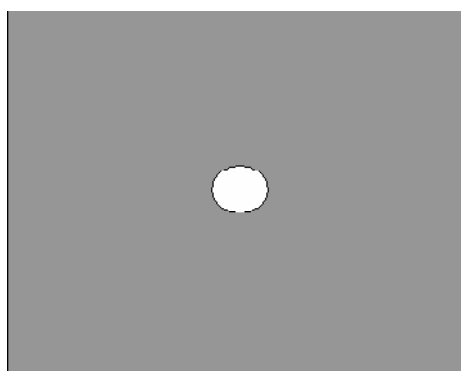
The components it has been used to construct the antenna are

- i) 123x123mm square section of blank PCB
- ii) 50mm length of 1/2" copper pipe
- iii) Short length of CNT-400 or LMR-400 low loss coax (~300mm long)
- iv) 250mm of 2.5mm² copper wire (approx 1.5mm diameter)
- v) N connector

It has been cut a square piece of blank printed circuit board, 123x123mm. 50mm section of copper pipe is taken and filed both ends smooth. Using sandpaper the copper pipe is polished up including the inside of the copper pipe, to ensure a good connection with the coax braid. A notch is cut into one end of the copper pipe, removing approx 2mm from half the circumference.

**Fig.-1.3.1 – Copper Pipe**

A hole is drilled in the centre of the blank PCB so that the copper pipe is a tight fit in the hole. It has been drilled a small hole and then widened it using file for making it precisely fit for inserting the copper pipe.

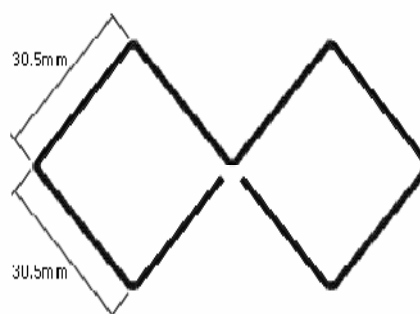


123mm × 123mm

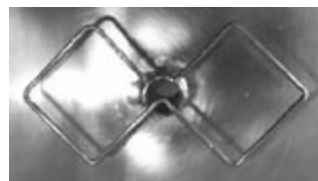
Fig. - 1.3.2– Square PCB used for construction

Copper pipe is inserted into the hole, with the notched end on the copper side of the blank PCB. The copper pipe protruded approx 16mm through the hole, measured on the copper side of the PCB. The copper pipe is soldered to the PCB to ensure better electrical connectivity. It is not possible to solder the two elements with normal 25W solder gun. It has been used a high power solder to connect these two elements.

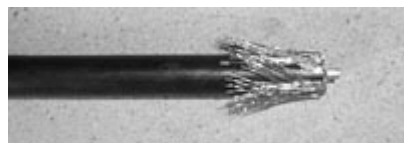
244 mm of copper wire is taken and is bent in as shown in the figure. All the bents are of 90 degrees.

**Fig.- 1.3.3 – Biquad Antenna Loop**

The element is now attached to the reflector. Only the two "ends" of the copper wire were to be attached to the copper pipe - the centre of the copper wire must not touch the copper pipe (hence the notch which was cut into the end of the copper pipe). Assembling everything as mentioned, our antenna looked as shown below.

**Fig.-1.3.4 – Biquad Loop Constructed**

For feeding antenna it has been stripped approx 30mm of the outer sheath from the end of the coaxial cable. The braid was folded back over the outer sheath the centre conductor is trimmed, so that about 4mm protruded. The outer braid is to be shorted to reflector (ground plane).

**Fig.- 1.3.5 – Stripping of Sheath**

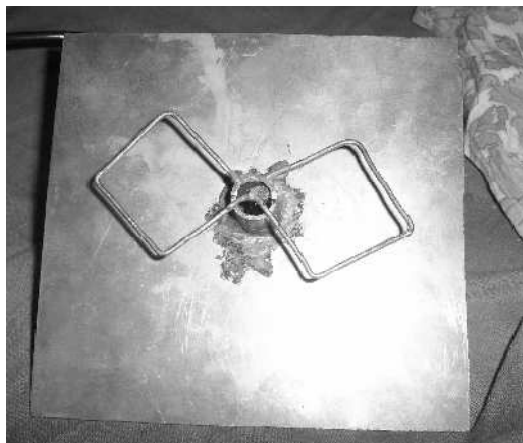


Fig.-1.3.6 Biquad Antenna Constructed

It has been inserted the braid into the copper pipe, so that the end of the centre conductor lined up with the extreme end of the copper pipe, and it has been then soldered the centre of the element to it, ensuring the centre of the element is not in contact with the copper pipe. At this stage it has been kept completely constructed the biquad antenna shown above Figure-1.3.6.

1.4 CONCLUSION

The overall working of antennas has been understood. The major parameters (such as return Loss curves, radiation Patterns, directivity and beam width) that

affect design and applications are studied and their implications understood. The constructed Biquad antenna operated at the desired frequency and power levels. Several patch antennas are simulated (using IE3D) and the desired level of optimization is obtained. It has been concluded that the hardware and software results it has been obtained and matched the theoretically predicted results.

1.5 REFERENCES

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